

EXPLORATORY ANALYSIS OF CARBON DIOXIDE LEVELS AND ULTRASOUND MEASURES OF THE EYE DURING ISS MISSIONS

M. Young¹, S. Mason², C. Schaefer², M. L. Wear¹, A. Sargsyan¹, K. Garcia¹, C. Coble¹, S. Gruschkus¹, J. Law³, D. Alexander³, V. Meyers³, and M. VanBaalén³

¹Wyle, ²MEIT, and ³NASA JSC.

Enhanced screening for the Visual Impairment/Intracranial Pressure (VIIP) Syndrome, including in-flight ultrasound, was implemented in 2010 to better characterize the changes in vision observed in some long-duration crewmembers. Suggested possible risk factors for VIIP include cardiovascular changes, diet, anatomical and genetic factors, and environmental conditions. As a potent vasodilator, carbon dioxide (CO₂), which is chronically elevated on ISS relative to typical indoor and outdoor ambient levels on Earth, seems a plausible contributor to VIIP. In an effort to understand the possible associations between CO₂ and VIIP, this study analyzes the relationship between ambient CO₂ levels on ISS and ultrasound measures of the eye obtained from ISS fliers. CO₂ measurements will be pulled directly from Operational Data Reduction Complex for the Lab and Node 3 major constituent analyzers (MCAs) on ISS or from sensors located in the European Columbus module, as available. CO₂ measures between ultrasound sessions will be summarized using standard time series class metrics in MATLAB including time-weighted means and variances. Cumulative CO₂ exposure metrics will also be developed. Regression analyses will be used to quantify the relationships between the CO₂ metrics and specific ultrasound measures. Generalized estimating equations will adjust for the repeated measures within individuals. Multiple imputation techniques will be used to adjust for any possible biases in missing data for either CO₂ or ultrasound measures. These analyses will elucidate the possible relationship between CO₂ and changes in vision and also inform future analysis of inflight VIIP data.